SANDY POINT FUN RUN:

A context for understanding and using scale

Anne Roche
Australian Catholic University
<anne.roche@acu.edu.au>

Anne Roche describes a challenging and engaging task that incorporates problem solving and the application of worthwhile mathematics. Roche discusses the challenges in this task for students and its potential to enhance student learning.

In the middle years of school, it is important that mathematics is challenging, engaging and focuses on worthwhile mathematics. In this article, I describe a lesson that seemed to have all three of these characteristics, as students grappled with issues of scale to create a fun run, given a range of challenging mathematical constraints.

The task presented in this paper was developed as part of a project called *Encouraging Persistence and Maintaining the Challenge* (EPMC). In this project, we have been creating sequences of challenging tasks and exploring teacher behaviours that help students to persist when working on such tasks.

The task I developed and describe here was inspired by research on problem solving and the use of contextual tasks that help motivate and engage students with important mathematics. For example, Thompson, Battista, Mayberry, Teatts and Zawojewski (2009) suggested that "good problems challenge students to develop and apply strategies, serve as a means to introduce new concepts, and offer a context for using skills" (p. 2). Clarke and Roche (2009) studied the use of mathematics embedded in a contextualised practical problem. In the Task Types and Mathematics Learning project, teachers in the project noted that one of the benefits of using this type of task was that the one task would often draw on a variety of mathematics topics and combine a variety of ideas and skills.

In this article, I outline the mathematical focus of a lesson I call Sandy Point Fun Run, describe how the lesson played out in some

Year 5/6 classrooms, discuss the particular challenges in this task for the students, and highlight its potential for learning a range of important ideas and skills.

The mathematical focus

The mathematical focus of the lesson is on interpreting a map including understanding and applying a coordinate system to specify locations, using map scale to find the distances between landmarks, and using knowledge of compass bearings to describe the location of landmarks. The relevant mathematics in the *Australian Curriculum: Mathematics* (AC:M) for Year 4 is "Use simple scales, legends and directions to interpret information contained in basic maps (ACMMG090)" (ACARA, 2010, p. 33) and Year 5 is "Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113)" (ACARA, 2010, p. 38). The relevant Year 6 content description for this sub-strand is "Introduce the Cartesian coordinate system using all four quadrants" (ACARA, 2010, p. 43). I believe the task is most appropriate to Years 5 and 6 because it requires that the students engage with a combination of content as well as addressing scale in a more complex way than is suggested for Year 4 in the AC:M.

Determining the distances between landmarks requires an understanding of the scale provided on the map and the use of proportional reasoning. This could be determined in several ways such as by counting grid squares in a horizontal or vertical direction between landmarks, by using some indirect measure such as a ruler to measure the distance in a straight line on the page then converting this measure to an actual distance on the map, or using a piece of string to determine the distance of a non-straight path on the page and converting this length to an actual distance on the map. Clarke and Roche (2009) described a task involving map scale and noted that students in the middle years were rarely asked to create or use a scale. Although students as young as four have been found to be capable of using grid references (Blades & Spencer, 1989), Battista (2007) noted the importance of students analysing the distances between points on a map.

Sandy Point Fun Run: Lesson outline

In the following sections, I describe how the lesson typically 'plays out' when I teach it.

Setting the scene

After gathering the students on the floor in front of the interactive whiteboard (IWB), I explain that the day's task involves reading a map. I ask the students to name some of the important features of a map. From my experience of teaching this lesson in several schools in Melbourne, the students are likely to suggest compass directions, grid coordinates and keys or legends, but rarely suggest scale.

If someone suggests compass directions, I ask the students to close their eyes, imagine their current location at school, and point in the direction they believe to be north. It is interesting to note the number of students who point 'up'. After determining the correct direction for north and south from their current location, we look at a compass on the IWB. I ask if there is someone who knows a clever way to determine the direction of east or west, if north is given. My experience is that at least one person in the class will know the mnemonic "Never Eat Soggy Weetbix," and use it to recall that east, south and west occur clockwise around the compass from North.

I then show the Sandy Point map (see Appendix 1) on the IWB and I ask a series of questions that focus the students on the features of the map and the elements of the task to come. These are:

- At what location is the tennis club? (Establish that it is important to say the letter before the number, i.e., D7. While arbitrary, this mathematical convention becomes especially important when recording grid references when both axes are numbers, for example in a Cartesian coordinate system where the *x*-axis is written before the *y*-axis. Also

note that the tennis club is on the south side of Lucy Road.)

- At what location is the police station? (Establish that it could be either E6 or F6 and also that it is on the north side of Lucy Road.)
- Please name one of the checkpoints. How do you know it is a possible checkpoint? (I am encouraging the students to notice that the symbol at the bottom of the map indicates that all rectangles with a cross in the centre are possible checkpoints.)
- What is the distance along Jack Road from the corner of Main Road to Station Street? How did you work it out? (Using the scale at the bottom of the map which indicates each square is 50 metres on the grid, the length of Jack Road is 125 metres.)

Outlining the task

I describe the task in this way:

My task for you today is to work in pairs, to design a fun run from the Sandy Point Primary School gate along various roads and back to the school gate.

1. The fun run must be between one and two kilometres long (noting that 1000 metres is one kilometre).
2. Along the way, the fun run must stop at exactly five checkpoints.
3. Students must keep track of how far it is from the school gate to each checkpoint and that these distances must be recorded on the table provided (see Appendix 2).
4. Students must record on the same table the location of the checkpoints, including the grid reference, the name of the street and on which side of the street it is located (e.g., the tennis club is on the south side of Lucy Road).
5. Finally, once students have drawn their route on the map (see Figure 1 for a student work sample), they are asked to describe, in words, the path or route that their course takes, being very careful to be clear about where to turn and where to stop.

I provide the two worksheet pages (Appendices 1 and 2) and a ruler for each pair of students.

At this point, I have not explicitly taught the students how to determine distances, as I am interested in seeing how they choose to do this.

While the students are on task

As the students attempt to solve the problem, I am on the lookout for an individual or pair's capacity to:

- read and clarify the task;
- determine direction;
- determine distances and how they choose to do this; and
- add the distances in order to make a progressive total in the last column.

I also select carefully which students I will ask to report back in the review stage of the lesson, advising them in advance that they will be asked to share their particular method for calculating the distances between the checkpoints. I usually begin with methods that are less sophisticated (such as counting grid squares) to those that are more sophisticated such as measuring some distance on the map with a ruler and converting this to an actual distance in reality (e.g., they may say 10 cm = 250 m). I have also noticed that some students will 'count by 25s' because 1 cm = 25 m.

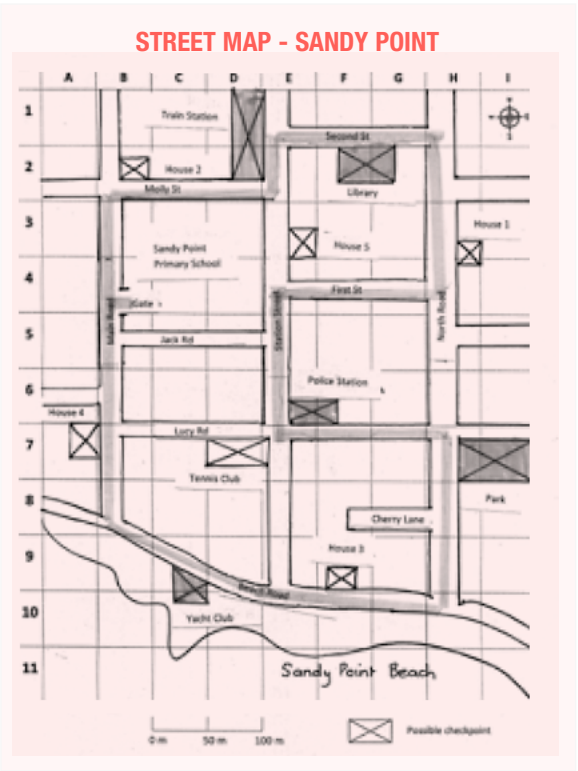

Figure 1. A student's work sample for Sandy Point Fun Run.

Pulling it together

After around half an hour working on the task, I bring the students back to the floor with their maps, their worksheets and a ruler. In this review time, the pairs of students I have selected earlier share with the class their method for calculating distances between the checkpoints (e.g., Figure 2). This review time allows the class to hear the thinking of others and engage with others' solution strategies.

Challenges for the students

Most students report that calculating the distances around corners and along Beach Road (which is curvy) are the most challenging features of the task. Some students have used a piece of string to measure the distance they have travelled along Beach Road (or the total fun run route) and then convert this to the actual distance. One pair of students marked the string every 4 cm, noting this distance was 100 metres in reality (see Figure 3) and then used this string as a kind of ruler to determine the distances between checkpoints.

Figure 2. A student explains their solution strategy at the IWB.

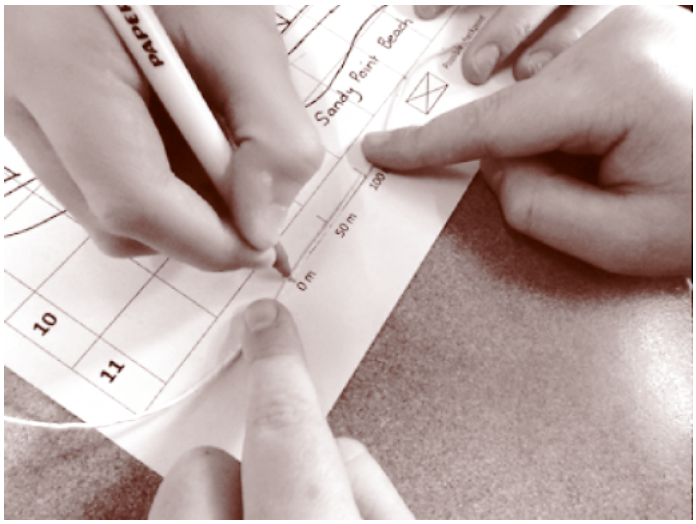

Figure 3. Students marking a piece of string every 4 cm.

Implications for teaching

This lesson has the potential to contribute to helping students learn more about an important and difficult mathematical concept—that of scale; while situating the task in a realistic situation that has proved to be engaging and motivating for students. The task also provides opportunities for students to learn more about compass directions and grid references.

References

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